

### Amendments to the Claims

1. (Currently Amended) A computer readable storage medium having ~~computer-executable software code carried thereon for executing on a computing device~~ encoded thereon a data structure for saving state ~~for a semantically accessible state binding method, comprising:~~ of a an executing program a plurality of times as the executing program executes over time, the a data structure comprising:

a first state frame ~~including:~~ comprising a representation of a first state of ~~an~~ the executing program, ~~and~~ ;

a second state frame ~~including:~~ comprising a representation of a second state of the executing program comprising state changes made by the executing program after the first state frame is created and the second state frame includes a pointer back to the first state frame; and

a third state frame ~~including~~ comprising a representation of state changes made by the executing program after a fork method creates the third state frame, and the third state frame includes a pointer back to the second state frame;

wherein the representations of state form a chain of state frames;

wherein ~~the executing program saves~~ a first state of the executing program is saved in the first state frame as a semantically accessible first state object, ~~saves~~ and a second state of the executing program is saved in the second state frame as a semantically accessible second state object, ~~and then returns to the first state of the program by using the first state object;~~

wherein the third state frame is empty when created by the fork method; ~~and~~

wherein, after the fork method creates the third state frame, a value of a variable of the executing program can be accessed by checking, in backwards order that the state frames were created, for the value of the variable in the chain of state frames respective frames; and

wherein at least one of the state frames in the chain of state frames comprises a cached value copied from a prior frame in the chain of state frames.

2. (Canceled)

3. **(Currently Amended)** The computer readable storage medium of claim 1 further comprising a fourth state frame which includes changes made by the executing program after the fork method creates the third state frame and after a set method returns the executing program to ~~the state of~~ a state indicated by the second state frame, and wherein the fourth state frame includes a pointer back to the second state frame.

4. (Previously Presented) The computer readable storage medium of claim 3 further comprising a joined state frame including a combination of state changes in the third and fourth state frames.

5. (Previously Presented) The computer readable storage medium of claim 3 wherein a first thread of the executing program makes state changes copied in the second state frame, and a second thread of the executing program makes state changes copied into the third state frame.

6. (Previously Presented) The computer readable storage medium of claim 1 wherein the second state frame includes unchanged state read from the first state frame.

7. **(Currently Amended)** A computerized method comprising:  
via an application programming interface, receiving ~~via an application programming interface~~ a request to create a state save;  
in response to the request, at a first point in time, saving, by a computer, a first representation of a state of an executing program, wherein the saving comprises ~~comprising~~ copying state of the executing program at the first point in time to ~~required to return to the moment the state was saved as~~ a first state frame;

creating a blank state frame with a backward link to the first state frame as a **first** current state frame;

**in the first current state frame**, maintaining a ~~second~~ representation of subsequent state comprising changes made to the state of the executing program after the ~~first representation~~ **first point in time in the current state frame**;

**via the application programming interface, receiving an other request to create a state save**;

**in response to the other request, at a second point in time, saving the first current state frame as a second state frame with a backward pointer to the first state frame**;

**creating an other blank state frame with a backward link to the second state frame as a subsequent current state frame, whereby a chain of state frames is generated**;

**in the subsequent current state frame, maintaining a representation of subsequent state comprising changes made to the state of the executing program after the second point in time**;

in response to a request for a value of a variable after the request to create a state save, checking for the value of the variable ~~in the first state frame~~, **wherein the checking comprises walking backward through the chain of state frames from a last state frame toward the first state frame until an update to the value for the variable in the chain of state frames is found**; ~~and~~

~~changing the current state frame to the first state frame upon receiving a state set request at the application programming interface~~

**in response to the request for the value of the variable, returning the update to the value for the variable in the chain of state frames as the value of the variable**; **and**

**as a result of the request for the value of the variable, copying an update from a prior state frame to a current state frame, thereby speeding up further accesses to the variable.**

8. (Canceled)

9. (Canceled)

10. (Canceled)

11. (Canceled)

12.-16. (Canceled)

17. (Canceled)

18. (Canceled)

19. (Canceled)

20.-29. (Canceled)

30. (Previously Presented) The computer readable storage medium of claim 3 wherein the data structure further comprises a fifth state frame with a pointer to the fourth state frame, wherein the fourth state frame further comprises a reference pointer with a value indicating how many frames point back to it, and wherein if the value of the reference pointer is one, then the executing program combines the fourth state frame with the fifth state frame.

31. (Previously Presented) The computer readable storage medium of claim 3 wherein the fourth state frame includes a pointer to the third state frame.

32. (Previously Presented) The computerized method of claim 7 further comprising writing the value of the variable in a cache in the current state frame.

33. (Currently Amended) The computerized method of claim 32 further comprising:

~~a threshold size wherein~~ when the cache is greater than ~~the~~ a threshold size, purging the cache ~~is purged~~.

34. (Currently Amended) The computerized method of claim 32 further comprising:

~~a threshold size wherein~~ when the cache is greater than ~~the~~ a threshold size, overwriting a ~~the~~ last used variable ~~is overwritten~~.

35. (Canceled)

36. (Canceled)

37. (Canceled)

38. (New) One or more computer-readable storage media having encoded thereon computer-executable instructions for performing a method comprising:  
receiving a request to create a state save;

in response to the request, at a first point in time, saving a first representation of a state of an executing program, wherein the saving comprises copying state of the executing program at the first point in time to a first state frame;

creating a blank state frame with a backward link to the first state frame as a first current state frame;

in the first current state frame, maintaining a representation of subsequent state comprising changes made to the state of the executing program after the first point in time;

receiving an other request to create a state save;

in response to the other request, at a second point in time, saving the first current state frame as a second state frame with a backward pointer to the first state frame;

creating an other blank state frame with a backward link to the second state frame as a subsequent current state frame, whereby a chain of state frames is generated;

in the subsequent current state frame, maintaining a representation of subsequent state comprising changes made to the state of the executing program after the second point in time;

in response to a request for a value of a variable after the request to create a state save, checking for the value of the variable, wherein the checking comprises walking backward through the chain of state frames from a last state frame toward the first state frame until an update to the value for the variable in the chain of state frames is found;

as the value of the variable, returning the update to the value for the variable in the chain of state frames; and

as a result of the request for the value of the variable, copying an update from a prior state frame to a current state frame, thereby speeding up further accesses to the variable.



39. (New) The one or more computer-readable storage media of claim 38 wherein at least one state frame in the state frame chain comprises a timestamp identifying a position in a partial ordered domain of time.

40. (New) The one or more computer-readable storage media of claim 39 wherein a fork method advances time of a current state and creates an independent time branch.

41. (New) The one or more computer-readable storage media of claim 39 wherein the method further comprises:  
joining a state with a current state.

42. (New) The one or more computer-readable storage media of claim 39 wherein the method further comprises:  
using the timestamp in a parallel composition.

43. (New) A specialized computer apparatus comprising:  
a processor;  
memory readable by the processor and storing computer-executable instructions for performing a method comprising:  
receiving a request to create a state save;  
in response to the request, at a first point in time, saving a first representation of a state of an executing program, wherein the saving comprises copying state of the executing program at the first point in time to a first state frame;  
creating a blank state frame with a backward link to the first state frame as a first current state frame;

in the first current state frame, maintaining a representation of subsequent state comprising changes made to the state of the executing program after the first point in time;

receiving an other request to create a state save;

in response to the other request, at a second point in time, saving the first current state frame as a second state frame with a backward pointer to the first state frame;

creating an other blank state frame with a backward link to the second state frame as a subsequent current state frame, whereby a chain of state frames is generated;

in the subsequent current state frame, maintaining a representation of subsequent state comprising changes made to the state of the executing program after the second point in time;

in response to a request for a value of a variable after the request to create a state save, checking for the value of the variable, wherein the checking comprises walking backward through the chain of state frames from a last state frame toward the first state frame until an update to the value for the variable in the chain of state frames is found;

as the value of the variable, returning the update to the value for the variable in the chain of state frames; and

as a result of the request for the value of the variable, copying an update from a prior state frame to a current state frame, thereby speeding up further accesses to the variable;

wherein at least one state frame in the chain of state frames comprises a timestamp.